THE IMPACT OF MACROECONOMIC VOLATILITY ON STOCK RETURN VOLATILITY: EVIDENCE FROM PAKISTAN STOCK MARKET

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Abstract

This study examines the impact of macro-economic volatility on stock return volatility for fifty stocks listed at the Karachi Stock Exchange using monthly data from July 1998 to June 2014. The macro-economic variables included in the analysis are market return, industrial production, inter-bank call money rate, term structure of interest rate, money supply, exchange rate and the inflation rate. The result of significant autoregressive process suggests existence of volatility persistence. The industrial production has a negative effect on stock market volatility and the volatility of exchange rate captures the external sector volatility and has a positive effect on stock return volatility. The increased variation in money supply and inflation make stock returns more volatile and an unexpected change in call money rate and the term structure of interest rate has the opposite effect on stock returns volatility. This leads to the conclusion that stock prices fluctuations in Pakistan are influenced by financial and economic variables' uncertainty. Therefore, investors, authorities and policy makers are needed to take into account the economic uncertainties while considering stock market volatility.

Keywords: Macroeconomic volatility, Stock returns volatility, Volatility persistence, Zellners's iterative procedure, Hendry general to specific modeling strategy, Karachi Stock Exchange

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Introduction

Since the last two decades, the stock market volatility is contributing in the key investment decisions and stock portfolio development for the investors as well as the portfolio managers. Volatility, perceived as risk is the fluctuation in the price movements of securities and remains high if the price movements show a rapid change in a short time periods and becomes low if the prices remain stable. The stock returns along with the economic indicators play an integral role in strengthening the financial position of a firm. Therefore, the policy makers remain concerned about the simultaneous functioning of the market shocks as well as the macro-economic factors on the asset returns. They usually rely on the market estimates of volatility of securities as a yardstick for the exposure to financial markets.

According to Schwert (1989), the economic variables have a key impact on the volatility of stock returns and if well accounted for in the conditional variance of the stock returns may tend not to over-estimate stock return volatility. Also, the economic factors play a pivotal role in the performance of the stock markets thereby affecting investor's confidence and obtaining capital gains on a long term basis (Fama and French, 2015) respectively.

This study has attempted to examine the empirical validity of some prominent economic variables that have already been tested for developed markets to see their impact for the Pakistani market respectively. The economic variables are relevant to the pricing movements of the financial markets, as it is evident from the multi-factor model (Ross, 1976) that the systematic economy wide factors are important that have general impact on the financial stock markets.

The key objective of the study is to examine the determinants of conditional volatility of the overall fifty stock returns (average) and fifty stock returns for the time period of July 1998 to June 2014 and the impact of macro-economic volatility on stock return volatility respectively. The macro-economic variables included in the analysis are market return (Rm), industrial production (Q), interbank call money rate (CR), term structure of interest rate (TS), money supply (MS), exchange rate (EX) and inflation rate (INF). In order to investigate the causes of stock market volatility, the methodology proposed by

Schwert (1989) is applied with some modification. The study has contributed to the existing literature in several ways. Firstly, the volatilities of macro variables are used as determinants of stock market volatilities and are innovative in terms of its estimation procedure. In the absence of any prediction by financial theory about focus of lag structure in the analysis of stock return volatilities and macro-economic volatilities, Hendry's general to specific strategy is used with Zellner's iterative procedure.

Regarding Pakistani market, this study aims to modify the current work done on the association between stock returns volatilities and macro-economic volatilities by employing Zellner's iterative procedure based on Hendry general to specific modeling strategy respectively.

This research study is further divided into four sections. Section two provides literature review of previous empirical work, section three discusses the data and methodology, the section four explains data analysis and interpretation of empirical results and section five explains the conclusion respectively.

Literature Review

Over the past three decades a substantial amount of attention has been directed towards the identification of the macro-economic variables that influence stock returns. Ever since the publication of Schwert (1989) paper, the linkage of macro-economic volatility with stock return volatility has attracted the attention of researchers in finance. As a result, researchers have proposed different economic factors to empirically estimate and analyze the seasonal and cyclical effects on stock return volatility along with the other firm specific factors respectively. Extensive research has also been conducted in the emerging markets to analyze and model the macro-economic volatility and stock return volatility respectively. Regarding the Pakistani market, Ali, Rehman, Yilmaz, Khan and Afzal (2010) find no causal relationship between Pakistani equity market and the macro-economic indicators whereas Mahmud and Dinniah (2009) find long-run significant relationship between stock prices and the inflation rates, the industrial production output, the foreign exchange rates of

almost all the selected Asia-Pacific countries for Malaysia where the relationship is found weak. Regarding the Bangladeshi market, Ahmed and Imam, (2007) find no co integration effect between stock returns and macro-economic variables except for interest change and T-bill growth rate respectively. The macro-economic factors employed in their study are money supply, Treasury bill rate, interest rate, GDP and industrial production index. Regarding the Australian market, Huynh, Mallik and Hettihewa (2006) studies the relationship between stock prices and macroeconomic variables identified as real GDP, interest rates, inflation and the population of the baby boomers ranging from 40-60 age groups. Based on vector auto regression (VAR) model, authors find a smooth long run co-integrated relationship between the stock prices and the macroeconomic variables of the Australian market respectively. Regarding the Sri Lankan market, Gunasekarage, Pisedtasalasai and Power (2004) have studied the relationship between macroeconomic variables and stock returns. The dataset comprises of market index and macroeconomic variables identified as money supply, 3-month treasury bill rate, consumer price index and exchange rate for the time period of 1985:1 to 2001:12. The results indicate long run equilibrium relationship between stock returns and rate of inflation, money supply and the treasury bill. Based on impulse response functions, authors find a swift causal relationship between the stock returns and macro-economic variables respectively.

Hassapis (2003) studies the relationship between the financial variables identified as stock prices, interest rates and its spreads, and monetary aggregates of Canada and the U.S. with the output growth of Canada for the time period of January 1966 to September 2000 on monthly basis. Based on non-parametric cross-correlation technique, authors find a significant relationship between the financial variables and output growth in both markets of Canada and Unite States. Flannery and Protopapadakis (2002) have studied the influence of macroeconomic factors on aggregate stock returns. The sample consists of 17 macro announcement series of NASDAQ market for the time period of 1980 to 1996. The authors conclude that no matter the underlying macro series affect prices but the time varying responses by the market may make equity returns insensitive to macro announcements.

Fifield, Power and Sinclair (2002) examine the relationship between the macroeconomic variables and the returns of emerging stock markets for the time period of 1987-1996 on monthly basis respectively. Based on principal components analysis, authors find a strong role of macroeconomic factors in explaining fluctuations in the returns of stock markets. Chaudhuri and Koo (2001) examine the relationship between domestic and international macroeconomic variables with the stock return volatility. The dataset comprises of the domestic and international macroeconomic variables and the stock returns of four markets identified as India, South Korea, Malaysia and Thailand for the time period of January 1980 to December 1995. Based on multiple regression analysis, authors find the co integration between the macroeconomic variables and the stock return volatility implying that a shock in one market would eventually affect the other market. Muradoglu, Taskin and Bigan (2000) studies the relationship between macroeconomic variables and stock returns of nineteen emerging markets for the time period of 1976 to 1997 on monthly basis. Based on Granger Causality tests, the authors find strong association between stock returns and macroeconomic variables and also at world market level based on financial liberalization.

Data and Methodology

This study investigates the determinants of conditional volatility of overall fifty stock returns (average) and fifty stock returns for the time period of July 1998 to June 2014 and the impact of macro-economic volatilities on stock returns volatilities. The macro-economic variables included in the analysis are market return, industrial production, interbank call money rate, term structure of interest rate, money supply, exchange rate and inflation rate. The stocks (firms) name and symbols are reported in table 3 of appendix A. In order to investigate the causes of stock returns volatilities, the methodology proposed by Schwert (1989) is applied with some modification.

Methodology

In order to specify the relationship of ex-ante economic factors with stock returns, the Rational Valuation Formula (RVF) is used, which sets the current price as a function of all expected dividends and expectation of discount rate. Poterba and Summers (1988) linearize the rational valuation formula to the following approximation.

$$P_{it} = E_t(\delta_{t+1}D_{t+1}) + E_t(\delta_{t+1}\delta_{t+2}D_{t+2}) + E_t(\delta_{t+1}\delta_{t+2}\delta_{t+3}D_{t+3} + \ldots\ldots \quad \textbf{(1)}$$

Here P_{it} is the price of asset i, E_t denotes conditional expectations based on the information available at time t, D_t is dividend, $\delta_t = 1/(1+r_f+r_p)$, r_f is risk free rate and r_p is risk premium.

The first step is estimating the stock returns, where R_{it} denotes the actual return and $E(R_{it}/I_{t-1}$ is expected return, conditional on available information set at time t-1. $\sigma_t^{R_{it}}$ Denotes the unconditional standard deviation return on stock i and $E\langle\sigma_t^{R_{it}} | I_{t-1}\rangle$ denotes its conditional standard deviation. Equation (1) shows the conditional expected return on stock that is the function of conditionally expected determinants of cash flow and discount rate.

$$E\langle R_{it} | I_{t-1}\rangle = F(Rm, CR, M, E, INF, Q, TS | I_{t-1}\rangle \quad \textbf{(2)}$$

The conditional standard deviation is function of the conditional standard deviation of the determinants of cash flows and discount rate given below:

$$E_t\langle\sigma_t^{R_{it}} | I_{t-1}\rangle = f\langle E(\sigma_t^{Rm}, \sigma_t^{CR}, \sigma_t^{M}, \sigma_t^{E}\sigma_t^{INF}, \sigma_t^{TS}\sigma_t^{Q} | I_{t-1}\rangle \quad \textbf{(3)}$$

Equation (3) provides the basis for the model determining the causes of volatility in Pakistani market. In order to implement the model, the conditional mean and standard deviation of relevant economic and financial variables and stock returns are needed to be estimated for which Davidian and Caroll (1987) method is used. Let F_k is the kth variable included in the model, its conditional mean is obtained by the following equation.

$$E\langle F_k | I_{t-1}\rangle = \alpha_1(L)F_k + \sum_{t=1}^{12} D_t + \varepsilon_{it} \quad \textbf{(4)}$$

Where F_k is the k_{th} economic variable, $\alpha_1(L)$ is the 12-th order polynomial in the lag operator L and D_t are monthly dummy variables in order to capture the season variation in the mean of a variable and $å_{it}$ is the residual variables. The equation (4) is estimated in general to specific form through stepwise backward elimination process and its insignificant components are eliminated.

The absolute value of the residuals obtained from equation (4) is used to estimate unconditional standard deviation of the k_{th} variable $\sigma_t^{F_k}$. The conditional standard deviation of the k_{th} variable is obtained as the fitted value of the variable by the following equation:

$$E\left\langle \sigma_t^{F_k} \,\middle|\, I_{t-1} \right\rangle = \beta(L)\sigma_t^{X_k} + \sum_{t=1}^{12} \beta_t D_t + \varepsilon_{it} \qquad \textbf{(5)}$$

Where, β(L) is 12-order polynomial in the lag operator L and D are dummy variables to capture seasonal variation in the standard deviation of the kth variable. $\sigma_t^{X_k}$ Is the single point estimator of unconditional standard deviation of kth variable. Since the expected value of $\sigma_t^{F_k}$ is less than the standard deviation obtained from a normal distribution, $E(\sigma_t^{F_k}) = \sigma_t^{F_k}(2/\pi)^{1/2}$ thus all the absolute errors are multiplied by the constant $(2/\pi)^{1/2}$ (Schwert, 1989).

The last equation given below relates the lagged conditional volatility of stock return i to its own lagged conditional volatility and to the lagged conditional volatilities of economic variables:

$$\hat{\sigma}_t^{R_i} = \lambda_0 + \sum_{k=1}^{K} \lambda_1(K)\sigma_t^{F_k} + \varepsilon_t \qquad \textbf{(6)}$$

Where $\sigma_t^{X_k}$ is the conditional volatility of k_{th} variable and $\lambda_1(K)$ are polynomials of 4th in the equation K=1, 2, 3…6. . The $\sigma_t^{X_k}$ includes the lagged conditional volatility of stock return i, market return (R_m), inflation (INF), industrial production (Q), money supply (M), exchange rate (EX), call money rate (CR) and term structure of interest rate (TS). The respective equation, therefore, develops the link between economic variable volatilities with stock returns volatilities respectively.

Data

The data used in this study include monthly returns for 50 stocks from July 1998 to June 2014 respectively. The monthly data is used because the economic variables used in the study are not available on daily frequency but monthly. The stocks are selected on the basis of active trading, representative of the sector and continuous listing on Karachi stock exchange during the time period of July 1998 to June 2014 respectively. The stocks (firms) name and symbols are reported in appendix A.

Empirical Results

The first step in estimation is the Augmented Dickey Fuller test applied to check the stationarity of all economic variables and stocks' closing prices. The returns term structure and stock returns are found to be stationary. The industrial production, money supply, inflation rate, exchange rate are non-stationary at level, however their log first difference are stationary. The results are reported in table 1. Similarly, the stock returns are found stationary at trend and intercept at log first difference. The log first difference results of the closing

prices of the fifty stocks are reported in Table 2. The summary statistics of the stock returns and the economic variables are reported in tables 3 and 4 respectively.

Table 1:
Unit Root Test (Economic Variables)

Economic Variables	Level	First difference
CR	-4.181*	
EX	-1.15	-4.16*
INF	-3.70	-5.70*
MS	-1.76	-12.60*
Q	-1.26	-7.00*
Rm	-3.75**	
TS	-3.74**	

Note: Unit Root test conducted on level at trend and on 1st difference at trend and Intercept

Table 2:
Unit Root Test (Stock Returns)

Stocks	1st Difference	Stocks	1st Difference	Stocks	1st Difference
AKBL	-23.96*	MLCF	-24.85*	DADX	-20.73*
HCAR	-21.47*	KASM	-21.87*	PAKT	-23.89*
ADOS	-22.06*	KTML	-21.73*	RCML	-24.63*
PSMC	-22.96*	HABSM	-23.37*	DAWH	-22.75*
CEPB	-22.42*	LINDE	-24.44*	SPLC	-23.46*
YOUW	-21.70*	MCB	-23.89*	SHEL	-21.72*
CENI	-37.05*	NAFL	-22.57*	AICL	-21.10*
DKTM	-20.65*	JDWS	-21.98*	EFUG	-22.86*
FABL	-22.38*	NESTLE	-22.78*	UPFL	-23.98*
FASM	-23.04*	NIB	-21.78*	ZAHID	-22.72*
FCCL	-21.77*	PAKD	-16.80*	ZHCM	-23.39*
LUCK	-22.56*	PGLC	-16.67*	ABOT	-22.50*
ZIL	-22.34*	PAKMI	-23.17*		
FZCM	-25.15*	PAKL	-25.87*		
ZELP	-23.39*	PIAA	-22.79*		
GHNL	-22.31*	PKGS	-22.18*		
SITC	-24.72*	MARI	-22.68*		
ISIL	-24.59*	ZTL	-21.39*		
ICI	-21.16*	PTC	-21.66*		

Note: Unit Root test conducted on level at trend and on 1st difference at trend and intercept. (The table 2 reports the results of the stocks that have become stationary on 1st difference at trend and intercept)

Table 3:
Summary Statistics of Stock Returns

	Mean	Standard Deviation	Skewness	Kurtosis	Jarque-Bera	Prob.
ABOT	0.001	0.10	-0.53	4.42	16.30	0.00
AKBL	0.001	0.15	-1.24	6.47	94.91	0.00
AICL	0.010	0.22	-0.46	5.47	36.26	0.00
ADOS	0.010	0.12	0.62	5.37	37.41	0.00
CEPB	0.010	0.11	0.19	3.73	3.54	0.17
CENI	0.000	0.11	-0.81	7.64	126.04	0.00
DADX	0.010	0.12	0.63	6.66	78.13	0.00
DAWH	0.011	0.11	0.71	6.19	63.77	0.00
DKTM	-0.011	0.13	1.81	13.58	641.21	0.00
EFUG	0.012	0.17	-1.06	6.57	89.57	0.00
FASM	0.001	0.13	-0.94	7.50	123.70	0.00
FCCL	-0.012	0.15	-0.70	4.36	19.71	0.00
FABL	0.001	0.14	-1.25	9.38	244.48	0.00
FZTM	0.031	0.15	4.30	30.94	4378.96	0.00
GHNL	0.011	0.21	0.90	4.28	25.43	0.00
HABSM	0.011	0.13	0.21	4.00	6.17	0.05
HCAR	0.001	0.17	-0.60	5.38	37.03	0.00
ICI	0.011	0.20	3.22	27.86	3435.23	0.00
ISIL	0.011	0.09	1.61	10.51	342.24	0.00
JDWS	0.031	0.15	1.22	6.95	110.66	0.00
KASM	-0.010	0.17	-0.18	6.86	78.16	0.00
KTML	0.010	0.19	0.65	5.78	48.29	0.00
LINDE	0.020	0.12	0.99	6.66	89.44	0.00
LUCK	0.021	0.18	-0.27	4.36	11.28	0.00
MLCF	-0.021	0.35	-6.75	66.95	22249.73	0.00
MARI	0.011	0.13	-0.10	4.07	6.08	0.05
MCB	0.021	0.15	-1.00	5.56	55.07	0.00
NAFL	0.001	0.07	0.29	8.21	140.60	0.00
NESTLE	0.021	0.11	0.47	6.09	54.40	0.00
NIB	0.001	0.23	0.50	3.10	5.35	0.07
PKGS	0.011	0.11	0.56	8.28	150.40	0.00
PAKMI	0.011	0.19	0.28	9.22	203.15	0.00
PAKD	0.011	0.14	0.38	3.74	5.89	0.05
PGLC	0.011	0.14	0.27	7.48	106.14	0.00
PSMC	0.011	0.15	0.69	4.89	28.32	0.00
PAKT	0.011	0.15	0.43	5.58	38.25	0.00
PIAA	0.001	0.18	0.51	4.95	25.16	0.00
PTC	0.001	0.12	0.02	3.29	0.45	0.80
RCML	0.011	0.13	0.56	5.10	29.00	0.00
SPLC	0.010	0.12	0.66	5.51	41.80	0.00
SHELL	0.011	0.10	-0.16	3.44	1.56	0.46
SITC	0.021	0.10	0.73	4.31	19.94	0.00
UPFL	0.011	0.07	1.19	12.07	458.09	0.00
YOUW	0.001	0.19	0.20	4.19	8.08	0.02
ZAHID	0.001	0.07	0.29	8.21	140.60	0.00
ZELP	0.001	0.23	0.50	3.10	5.35	0.07
ZHCM	0.011	0.16	0.26	5.00	21.80	0.00
ZIL	0.001	0.13	-0.94	7.50	123.70	0.00
ZTL	-0.011	0.15	-0.70	4.36	19.71	0.00

Table 4:
Summary Statistics of Economic Variables

Economic Variables	Mean	Standard Deviation	Skewness	Kurtosis	Jarque-Bera	Prob.
CR	**0.580**	**0.56**	**-0.20**	**2.45**	**155.75**	**0**
EX	**0.801**	**0.110**	**0.74**	**5.66**	**448**	**0**
INF	**0.680**	**0.44**	**-0.29**	**4.36**	**764**	**0**
MS	**0.870**	**0.74**	**0.16**	**3.33**	**423**	**0**
Q	**0.931**	**0.68**	**0.53**	**1.92**	**411.48**	**0**
Rm	**0.771**	**0.44**	**-0.98**	**2.93**	**419.28**	**0**
TS	**0.292**	**0.48**	**0.22**	**1.99**	**311.58**	**0**

In order to estimate conditional volatility of stock returns and economic variables, the innovation series for each variable is estimated. Following Kearney and Daly (1998), each variable is regressed on its own twelve lags and twelve monthly dummies. The estimated values for each of these equations are used as conditional standard deviation or conditional volatility of each variable.

The study estimates 51 models; one for overall fifty stocks (average) and other for fifty stock returns respectively. Each model contains 15 equations, the first 7 equations are to obtain the innovations of the relevant variables: market return (RM), growth in industrial production (IP), growth in money supply (MS), inflation rate (INF), term structure of interest rate (TS), foreign exchange rate (EX), call money rate (CR) and stock return considered (Rt). The next 7 equations are for estimation of conditional volatility of each of these variables. The last equation links the conditional stock return volatility to its own first lag level and first lags of conditional volatilities of economic variables. The model is initially estimated by above mentioned lag structure and these equations are restricted by excluding statistically irrelevant variable using Theil specification (Maddala, 2001). The result of the last equation obtained at the final estimation model is reported in Annexure II.

The results indicate that most of the stocks have positive and significant intercept term showing that homoskedastic part of the volatility is significant. The results of lag dependent variable are significant indicating that the conditional volatility of stock returns responds dynamically to its own past trend. Some coefficient of lagged

conditional volatilities have negative sign but in general the coefficient with positive sign dominate the ones with negative sign which indicates the oscillating behavior in conditional stock market volatility which is a short lived phenomenon and also provides evidence of volatility persistence.

For most of the stocks in general the industrial production volatility is associated with higher conditional stock return volatility indicating that real sector affects the expectation of investor about future earnings and their decision to invest and makes the market volatile. The growth rate of money supply negatively affect volatility of stock returns, the conditional volatility of inflation positively affects the stock return volatility. The volatility of exchange rate has positive effect on stock return volatility for most of the stocks which suggests that with foreign equity risk the unpredictable behavior of foreign investor increases the conditional volatility of stock returns.

The present study tends to be a comprehensive academic study that engulfs in itself all of the key economic factors that may influence the stock return volatility. The results indicate that the conditional volatility of the stock returns on average and the firm level responds dynamically to the conditional volatilities of economic indicators included in the study.

Conclusion

This study examines the determinants of conditional volatility of overall fifty stocks returns (average) and fifty stock returns for the time period of July 1998 to June 2014 and the impact of macro-economic volatilities on stock returns volatilities respectively. The monthly data is used because the economic variables used in the study are not available on higher frequency but monthly. The macro-economic variables included in the analysis are market return, industrial production, interbank call money rate, term structure of interest rate, money supply, exchange rate and inflation rate. In order to investigate the causes of stock market, the methodology proposed by Schwert (1989) is applied with some modification. The study has contributed to the existing literature in several ways. Firstly, the volatilities of macro variables are used as determinants of stock market

volatilities and are innovative in terms of its estimation procedure. In the absence of any prediction by financial theory about the focus of lag structure in the analysis of stock return and macro volatilities Hendry's general to specific strategy is used with Zellner's iterative procedure.

The results lead to general conclusion that the stock prices volatility in Pakistan is influenced by financial and economic indicators included in the study. This indicates in the long run that the underlying activities depend on the economic variable volatility. It follows from the results that the conditional volatility of the stock returns on average and firm level responds dynamically to the conditional volatilities of economic indicators included in the study. The significant autoregressive process indicates existence of volatility persistence. The industrial production has adverse effect on stock market volatility and the volatility of exchange rate captures the external sector volatility and has positive effect on the stock return volatilities. The increased variation in money supply and inflation make stock returns more volatile and unexpected change in call money rate and term structure of interest rate adversely affects the stock return.

The present study empirically makes evident that the stock returns volatilities tend to behave as the barometer of the stock market for investors and market participants and most importantly for economic policy makers and the Securities and Exchange Commission of Pakistan keeping in view the prominent role played by the economic factors that help to shape up the trading strategies. Moreover, the policy implications of the study are of economic and financial uncertainty matter for stock market volatility. Therefore investors, authorities, managers, researchers, academicians and policy makers are required to keep in mind the economic volatilities while considering stock market volatility.

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Appendix A II

List of the Stocks (Firms) and Symbols

S.No	Stock (firm) Name	Symbol
1	**Abbott Laboratories Pakistan Ltd**	**ABOT**
2	**Askari Commercial Bank Ltd**	**AKBL**
3	**Adamjee Insurance Co Ltd**	**AICL**
4	**Ados Pakistan Ltd**	**ADOS**
5	**Century Insurance Co Ltd**	**CENI**
6	**Century Paper**	**CEPB**
7	**Dadex Eternit Ltd**	**DADX**
8	**Dawood Hercules Chemicals Ltd**	**DAWH**
9	**Dewan Khalid Textile Mills Ltd**	**DKTM**
10	**EFU General Insurance Co Ltd**	**EFUG**
11	**Faisal Spinning**	**FASM**
12	**Fauji Cement Co Ltd**	**FCCL**
13	**Faysal Bank Ltd**	**FABL**
14	**Fazal Cloth**	**FZCM**
15	**Ghand Nissan**	**GHNL**
16	**Habib Sugar Mills Ltd**	**HABSM**
17	**Honda Atlas Cars Ltd**	**HCAR**
18	**ICI Pakistan Ltd**	**ICI**
19	**Ismail Industry**	**ISIL**
20	**JDW Sugar Mills Ltd**	**JDWS**
21	**Karim Cotton**	**KACM**
22	**Kohinoor TextileXD**	**KTML**
23	**Linde Pakistan**	**LINDE**
24	**Lucky Cement**	**LUCK**
25	**MapleLeaf CementXD**	**MLCF**
26	**Mari Petroleum**	**MARI**
27	**MCB Bank Ltd XD**	**MCB**
28	**National Fiber**	**NAFL**
29	**Nestle Pak**	**NESTLE**
30	**NIB Bank Limited**	**NIB**
31	**Packages Ltd.**	**PKGS**
32	**Pak Mod.**	**PAKMI**
33	**Pak DatacomXD**	**PAKD**
34	**Pak Leather**	**PAKL**
35	**Pak Gum & Chem.**	**PGLC**
36	**Pak Suzuki**	**PSMC**
37	**Pak TobaccoXD**	**PAKT**
38	**P.I.A.C.(A)**	**PIAA**
39	**P.T.C.L.**	**PTC**
40	**Reliance Insurance Co Ltd**	**RCML**
41	**Saudi Pak Leasing**	**SPLC**
42	**Shell Pakistan**	**SHEL**
43	**Sitara Chemical**	**SITC**
44	**Unilever Foods**	**UPFL**
45	**Yousuf Weaving**	**YOUW**
46	**ZahidJee Tex. XB**	**ZAHID**
47	**Zeal Pak.**	**ZELP**
48	**Zahoor Cotton**	**ZHCM**
49	**ZIL Limited**	**ZIL**
50	**Zephyr Textile**	**ZTL**

Annexure II: Estimates of Conditional Volatilities of Overall Fifty Stocks Returns (average) and Stock Returns

Stocks	C	$\sigma^{R_a}_{t-1}$	σ^{CR}_{t}	σ^{CR}_{t-1}	σ^{E}_{t}	σ^{E}_{t-1}	σ^{M}_{t}	σ^{M}_{t-1}	σ^{Q}_{t}	σ^{Q}_{t-1}	σ^{RM}_{t}	σ^{RM}_{t-1}	σ^{TS}_{t}	σ^{TS}_{t-1}	σ^{INF}_{t}	σ^{INF}_{t-1}
Overall 50 stocks (Average)	0.04	-0.03*	0.01*	0.01**	0.24**	-0.20	-0.58**	-2.45*	0.02	-0.01**	0.05	0.12*	0.37*	2.71*	-0.02*	-0.02*
t-values	1.65	-2.28	1.79	1.70	1.64	-0.50	0.57	-2.47	-0.36	-1.90	0.68	1.83	2.55	2.21	-3.94	-2.82
ABOT	0.05	-0.03	0.02**	0.05*	1.10*	-0.88*	1.33	-5.70**	0.01	0.02**	0.71*	0.47	0.64	4.30*	-0.02	-0.03**
t-values	0.55	-0.03	0.86	1.91	1.78	-1.62	0.36	-1.79	0.07	-1.84	2.01	1.24	1.42	1.95	-0.64	-1.84
AKBL	-0.15	0.12	0.02**	0.04**	0.83**	0.23	0.53	0.01	0.00	-0.02**	0.40**	1.23*	0.66	35.23	0.03	-0.05**
t-values	-1.32	1.21	1.62	1.84	1.80	0.14	0.12	0.81	0.47	-1.87	1.94	2.80	1.22	0.65	-0.13	-1.80
AICL	0.31	0.03	0.03*	0.00	-0.27	1.96**	1.03	-4.78**	-0.01	-0.02	0.74**	0.48	-0.78	23.98	-0.09**	-1.80
t-values	1.48	0.26	1.82	-0.07	-0.09	1.63	0.13	-1.81	-2.25	-0.12	1.96	0.61	-0.79	0.25	-1.79	-0.54
ADOS	0.32	0.02	-0.03	-0.04**	-2.18**	1.01**	-1.75*	-1.29	-0.02	-0.03**	0.24	0.44*	-0.56	36.05	-0.05**	-0.03**
T-values	2.47	0.21	-0.81	-1.86	-1.95	1.82	-3.46	-0.25	-0.46	-1.81	0.50	1.90	-0.93	0.60	-1.86	-1.90
CEPB	-0.09	-0.01	0.02**	-0.01	0.44	-2.38**	-5.48**	-3.88**	0.02**	-0.02**	0.51	0.19	-0.37	1.58	-0.01	-0.03
t-values	-0.73	-0.05	1.71	-0.46	0.19	-1.94	-1.88	-1.86	-1.78	-1.80	1.17	0.43	-0.22	2.92	-0.37	-1.07
CENI	0.01	0.04	0.02**	-0.01	0.51	-4.19**	-3.99**	2.53***	-0.04*	-0.03*	0.58**	-0.19	0.29	1.73	-0.04**	-0.02**
t-values	0.12	0.41	1.89	-0.35	0.21	-1.73	-1.89	1.67	-1.99	-2.00	1.71	-0.44	0.53	3.05	-1.84	-1.96
DADX	0.41	-0.15	-0.01	-0.04**	-2.50**	-0.74	-7.55**	0.25	-0.01	-0.01**	-0.09	-0.18	-0.40	0.33	-0.05**	-0.02**
t-values	3.47	-1.49	-0.36	-1.87	-1.82	-0.41	-1.73	0.05	-2.02	-1.75	-0.26	-0.41	-0.69	0.58	-1.90	-1.73
DAWH	0.06	-0.03	0.01	0.01	1.12**	0.32	-3.67**	-5.99*	-0.01	0.02	-0.12	0.13	0.19	0.64	-0.02**	-0.01
t-values	0.45	-0.33	0.24	0.16	0.85	0.15	-1.69	-2.14	-0.45	0.53	-0.29	0.26	0.28	0.97	-1.65	-0.28
DKTM	-0.04	0.16	-0.08**	0.03**	1.38	-2.63	1.78	-5.79*	-0.01**	-0.03**	1.17*	0.43**	1.87	-1.10	-0.01	-0.03**
t-vales	-0.31	1.76	-2.26	1.85	0.50	-0.94	0.35	-2.15	-1.72	-1.78	2.44	1.83	2.94	-1.70	-0.49	-1.97
EFUG	0.07	0.08	-0.05	0.03	0.94**	0.84	-0.24	-1.51**	0.02**	0.02**	0.58*	0.27**	-0.19	-0.11	-0.01	0.00
t-values	0.99	0.83	-0.24	-0.21	1.84	0.72	-0.08	-1.82	-1.98	1.97	2.58	1.91	-0.51	-0.29	-0.56	-0.30
FASM	-0.01	-0.02	-0.05	0.04	3.43**	-0.20	3.43**	1.09***	0.00	0.03	-0.26	0.39**	1.50	1.23	-0.04**	0.02
t-values	-0.06	-0.23	-1.25	0.02	1.83	-0.08	1.85	-1.77	-1.04	0.63	-0.44	1.62	1.92	1.58	-1.91	0.52
FCCL	0.08	-0.08	0.01	0.02**	0.58	0.72	-1.11	-0.07	0.01*	-0.01**	0.01*	0.38*	0.59	-0.55	-0.05*	-0.03**
t-values	0.92	-0.77	0.42	1.80	0.47	0.58	-0.35	-0.02	-2.22	=1.70	2.05	1.88	-0.15	-1.41	-2.19	-1.87
FABL	0.04	0.14	0.01	0.04**	2.12	-0.76	2.28	-7.07**	0.03	0.02	1.65*	1.52*	-0.15	-0.29	-0.01	-0.05**
t-values	0.27	1.31	0.20	1.82	1.05	-0.37	0.43	-1.85	0.54	0.43	4.01	2.91	-0.22	-0.44	-0.18	-1.85
FZCM	-0.09	-0.03	-0.01	-0.05	-1.18	-1.15	0.99	-4.8***	0.01**	-0.05**	0.31*	0.44**	0.14	0.14	0.04**	0.05*
t-values	-0.46	-0.26	-0.12	-1.01	-0.30	-0.30	0.14	-1.65	1.88	-1.91	2.45	1.61	0.14	0.14	1.98	2.06
GHNL	0.10	-0.06	-0.02	0.01	-0.97	-1.14	6.21	-3.87	-0.01**	0.03	-.61**	1.27	0.79	1.24	-0.04	-0.04
t-values	0.44	-0.61	-0.30	0.12	-0.30	-0.34	0.73	-0.46	-1.82	-0.53	1.74	1.48	0.75	1.19	-0.70	-0.73
HABSM	0.04	0.04	0.01	-0.01	0.79	1.12**	0.80	-3.99**	-0.01	-0.03**	0.63**	-0.06	0.31	0.13	-0.06*	0.05**
t-values	0.30	0.38	0.26	-0.37	0.45	1.62	0.17	-1.88	-0.34	-1.90	1.73	-0.12	0.54	0.23	-2.04	1.98
HCAR	0.02	-0.04	0.03**	0.02**	-1.31	0.43	-1.08*	-6.97*	0.04	-0.03	-0.04	0.95**	0.58	76.26	-0.09*	-0.01
t-values	0.13	-0.41	1.83	1.58	-0.54	0.17	-2.16	-2.11	-0.30	-0.61	-0.01	1.89	0.72	0.98	-2.08	-0.13
ICI	-0.22	0.07	0.03**	-0.08**	1.71**	5.45**	-5.03**	-4.52**	0.01*	-0.01**	0.53**	0.12	0.67	2.19	-0.04**	-0.01
t-values	-1.14	0.66	1.76	-1.71	1.60	1.89	-1.68	-1.62	2.14	-1.74	1.74	0.16	0.74	2.42	-1.94	-0.20
ISIL	-0.15	-0.02	-0.01	0.00	-0.71**	0.74**	-3.10**	-3.44**	0.01*	-0.01**	0.39**	0.81*	0.91	6.30	0.04**	-0.02**
t-values	-1.88	-0.15	-0.47	0.01	-1.61	1.62	-2.02	-1.75	2.91	-1.89	1.81	2.64	2.41	0.16	1.87	-1.84
JDWS	0.01	-0.04	0.03**	0.01	0.39	-1.32	-5.67**	-0.05*	-0.01*	-0.03**	1.24**	-0.40	1.64	0.08	-0.12*	0.00
t-values	0.04	-0.32	1.83	0.20	0.15	-0.49	-1.82	-2.01	-2.02	-1.80	1.86	-0.57	1.91	0.00	-2.64	0.05
KASM	0.13	0.04	-0.01	-0.02	2.48**	-3.69*	-0.23*	-7.55**	-0.01**	0.01***	0.48**	0.36	0.81	0.19	-0.05**	-0.01
t-values	0.81	0.32	-0.29	-0.46	1.95	-1.86	-2.04	-1.77	-1.76	1.70	1.82	0.59	1.08	0.26	-1.81	-0.28
KTML	0.33	0.14	0.01	0.01	-5.36**	-1.52	-1.12**	-2.13	-0.01**	-0.01*	0.65**	-0.84	1.59	-0.41	-0.07**	-0.10**
t-values	1.59	1.21	0.16	0.17	-1.87	-0.37	-1.82	-0.28	-1.83	-2.19	1.86	-1.01	1.69	-0.42	-1.80	-1.78
LINDE	0.05	-0.03	0.03	0.03**	-1.35	0.75	-3.08**	-7.31**	0.01**	0.02	0.51*	0.48**	-1.01	1.24	-0.04	-0.04**
t-values	0.30	-0.30	0.02	1.70	-0.42	0.24	-1.81	-1.81	1.70	0.39	1.87	1.83	-1.42	1.76	-1.91	-1.77
LUCK	0.26	0.17	0.02	-0.01	2.79*	-1.47**	-5.35**	-7.56**	-0.01**	0.01	0.87**	-0.17	-0.16	0.65	-0.04**	-0.02
t-values	1.61	1.59	0.44	-0.35	2.18	-1.61	-1.87	-1.86	-1.83	0.28	1.77	-0.27	-0.20	0.86	-1.98	-0.41
MLCF	0.00	0.10	0.03**	0.03**	-1.11	4.25**	-1.63	1.17	0.02	-0.01**	0.63	0.20	0.27	0.44	0.01	-0.02
t-values	0.02	0.94	1.76	1.82	-0.39	2.47	-0.22	0.16	0.01	-1.71	0.88**	0.27	0.28	-0.49	0.18	-0.43

MARI	-0.03	-0.20	0.01	0.01	2.69**	-3.02**	-4.08**	-3.99**	0.04**	0.02	1.79*	0.66**	0.44	0.19	-0.06**	0.03
t-values	-0.23	-1.89	0.21	0.31	1.81	-1.84	-1.76	-1.76	-1.77	0.60	2.13	1.90	0.65	0.29	-1.86	0.76**
MCB	0.02	-0.01	0.01	0.01	1.02	1.82	1.79	-9.05**	0.02	0.02	0.73**	0.79**	0.49	0.30	0.01	-2.60
t-values	0.13	-0.10	0.04	0.32	0.52	0.91	0.35	-1.81	0.01	0.53	1.88	1.94	0.77	0.61	0.40	-1.99
NAFL	0.02	-0.10	-0.07	0.01	-2.15*	0.57	0.09	-0.82*	0.03	0.07	0.25**	0.05	-0.19	0.28	-0.01	-0.02
t-values	0.25	-0.89	-0.03	0.15	-1.84	0.36	0.03	-2.28	-0.22	0.34	1.83	0.18	-0.50	0.74	-0.46	-0.87
NESTLE	0.20	0.02	0.03	-0.04*	-1.80	-1.47	-0.25*	-3.56	0.02**	0.05	-0.37**	-0.07	-1.22	0.98	-0.04	0.01
t-values	1.89	0.23	1.19	-3.03	-1.15	-0.94	-2.06	-0.90	-1.74	0.17	-1.95	-0.18	-2.43	1.93	-1.42	0.35
NIB	0.24	-0.14	-0.06	0.02	3.30*	-0.60	2.26	-0.20*	-0.01*	-0.01**	0.57**	1.20	3.16	0.43	-0.09**	-0.05**
t-values	1.11	-1.41	-1.12	0.32	1.83	-0.18	0.26	-2.38	-2.30	-1.74	1.70	1.42	3.03	0.40	-1.89	-1.98
PAKD	0.10	-0.05	0.02	0.03**	1.37**	2.53**	-3.31**	-3.71**	0.01	-0.10	-0.56**	0.56	0.89	-8.81	-0.03**	-0.03**
t-values	0.67	-0.42	0.45	-1.76	-1.62	1.83	-1.88	-1.66	-0.24	-0.03	-1.80	0.96	1.25	-0.12	-1.93	-1.69
PAKMI	0.19	0.02	-0.04**	0.01	2.05**	-3.67**	4.81**	-0.17*	0.01	-0.03**	-0.02	1.22*	-0.89	0.74	-0.03	-0.09*
t-values	1.13	0.25	-1.92	0.20	1.84	-1.88	1.75	-2.79	0.97	-1.73	-0.04	1.91	-1.14	-0.25	-0.81	-2.15
PAKL	0.27	-0.01	0.01	-0.07**	1.16	7.09**	2.69	-4.43**	-0.01**	-0.08**	1.41**	2.17*	-1.92	1.26	-0.04*	-0.04**
t-values	1.00	-0.11	0.10	-1.94	0.30	1.77	0.26	-1.84	-1.98	-1.81	1.82	2.08	-1.51	1.00	-1.58	-1.85
PGLC	0.15	0.14	0.03	0.01	-0.44	-3.00	3.20**	-0.13*	0.02	0.01*	0.46**	0.33**	0.20	-0.44	-0.04**	-0.07*
t-values	1.21	1.48	-0.12	0.31	-0.24	-1.56	1.65	-2.75	0.68	1.39	1.97	1.65	0.32	-0.74	-1.86	-2.05
PIAA	0.08	-0.03	0.03	0.02	-6.30	-1.24	0.12	-2.74	-0.01*	-0.03**	0.61*	0.92*	0.65	0.63	-0.03*	-0.03**
t-values	0.42	-0.25	0.59	0.43	-1.60	-0.31	0.02	-0.37	-2.14	-1.86	1.82	2.19	0.73	0.68	-1.86	-1.64
PKGS	-0.04	0.01	-0.02	0.01	0.85	-1.79**	4.55	1.52	0.00	-0.03*	-0.18	-0.08	1.10	0.77	-0.01**	-0.01**
t-values	-0.40	0.08	-0.96	0.24	0.40	-1.86**	1.17	0.38	0.40	-2.02	-0.47	-0.21	2.21	1.56	-1.54	-1.54
PSMC	-0.04	0.08	0.04**	0.03**	-2.96*	1.82	3.49	3.55	0.01	-0.49*	-0.74	0.01	-0.24	1.02	-0.03**	0.02
t-values	-0.24	0.73	1.98	1.63	-1.88	0.76	0.58	0.60	-0.32	-2.00	-1.26	0.02	-0.32	1.68	-1.67	0.54
PTC	0.03	0.00	0.01	-0.02**	0.63	0.84	3.91	-3.88	0.80	0.01	0.27**	0.38*	0.35	2.38	-0.04	0.00
t-values	0.27	-0.04	0.48	-1.68	0.38	0.50	0.90	-0.90	-0.51	0.05	1.64	1.87	0.64	0.04	-1.42	-0.05
PAKT	-0.14	-0.04	-0.02	0.02	-5.63**	1.15	9.61	4.09	-0.05	0.01*	0.64**	0.67**	1.07	0.93	-0.05	-0.03
t-values	-0.89	-0.33	-0.39	0.56	-1.88	0.34	1.55	0.64	-0.12	1.87	1.88	1.94	1.24	-1.23	-1.21	-0.65
RCML	0.08	-0.11	-0.04**	0.02	-5.44*	-1.94**	0.17	7.31	0.00	0.02**	0.41**	-0.58	-0.11	0.45	0.03*	-0.01
t-values	0.57	-0.94	-1.89	0.44	-1.78	-1.63	0.03	1.31	-0.86	-1.82	1.72	-1.02	-0.15	0.64	1.71	-0.35
SPLC	0.13	0.00	0.02**	-0.02**	1.25**	-1.12	5.53	-0.14	0.02	-0.03	0.48	0.15	-8.18	-0.40	-0.01	-0.07*
t-values	1.02	0.01	1.78	-1.66	10.67	-0.59	1.13	-2.88	0.70	-0.01	1.02	0.31**	-0.14	-0.67	-0.44	-2.16
SHEL	0.04	-0.13	0.01	-0.02**	0.07	-0.73	-4.47*	-4.19*	-0.02	0.02*	0.18	1.63	0.52	0.76	-0.03**	-0.03**
t-values	0.44	-1.26	0.46	0.95	0.05	-0.52	-1.81	-2.19	-0.86	1.97	0.53	1.73	1.17	1.73	-1.80	-1.87
SITC	0.10	-0.03	-0.01	-0.04**	-2.36**	1.27	-2.63	-0.67	-0.03	-0.02	-0.07	0.15	1.39	0.81	0.01	-0.04**
t-values	0.83	-0.33	-0.43	-1.80	-1.87	0.72	-0.58	-0.15	-1.11	-0.57	-0.16	0.34	2.41	1.43	0.18	-1.84
UPFL	0.05	-0.05	-0.03**	0.07	0.46	0.04	0.25	-3.71**	-0.01	-0.05	0.24	-0.05	0.44	10.65	-0.02**	0.02
t-values	0.95	-0.42	-1.96	0.02	0.55	0.04	0.11	-1.73	-0.74	-0.32	1.14	-0.21	1.61	0.39	-1.81	0.02
YOUW	0.10	0.00	-0.07	-0.01	7.74**	0.35	3.51	0.07	0.01	-0.01*	0.18	0.36	-0.34	0.80	0.04**	0.07**
t-values	0.51	0.03	-1.49	-0.25	-1.96	0.09	0.49	0.01	1.34	-1.74	0.26	0.51	-0.35	0.82	1.78	1.83
ZAHID	0.04	0.04	0.02	-0.03	0.79	1.12**	0.80	-5.99**	-0.01	-0.03**	0.63**	-0.08	0.31	0.13	-0.06*	0.05**
t-values	0.10	0.18	0.29	-0.39	0.54	1.72	0.19	-1.88	-0.34	-1.90	1.73	-0.12	0.54	0.23	-2.14	1.89
ZELP	0.01	-0.07	0.03**	0.02**	-1.13	0.34	-1.09*	-6.79*	0.04	-0.03	-0.04	0.95**	0.58	6.26*	-0.09*	-0.03
t-values	0.13	-0.14	1.87	1.85	-0.45	0.17	-2.16	-2.11	-0.40	-0.61	-0.01	1.89	0.72	1.98	-2.99	-0.13
ZHCM	-0.22	0.17	0.07**	-0.08*	1.71**	5.45**	-5.03**	-5.52**	0.05*	-0.09**	0.59**	0.12	0.79*	2.19*	-0.07*	-0.10
t-values	-1.14	0.66	1.76	-1.91	1.97	1.98	-1.86	-1.92	2.14	-1.79	1.79	0.16	1.74	2.42	-1.99	-0.40
ZIL	-0.18	-0.05	-0.01	0.05	-1.71*	1.84**	-3.10**	-3.44**	0.01*	-0.01**	0.38**	0.89*	0.91	6.30	0.04**	-0.02**
t-values	-1.88	-0.15	-0.47	0.12	-1.91	1.62	-2.02	-1.75	2.91	-1.89	1.81	2.64	2.41	0.16	1.89	-1.94
ZTL	0.01	-0.04	0.03**	0.15	0.93*	-1.32	-5.67**	-0.15*	-0.01*	-0.03**	1.24**	-0.40*	1.64*	0.08	-0.12*	0.00